

3.1 Intro to Quadratic Relations	
So far: Linear Relations	New: Quadratic Relations
Equation: $y = mx + b$	Equation: $y = ax^2 + bx + c$
m is slope, b is y-intercept	a , b , and c are coefficients
highest exponent of x is 1	highest exponent of x is 2 (degree, or order, of 2)
	$y = a(x-r)(x-s)$ <p>factored form</p> $y = a(x-h)^2 + k$ <p>vertex form</p>

Mar 20 - 4:17 PM

Recall: To graph a relationship, we can use a table of values (or TOV).

1. Pick some values for x . $-2, -1, 0, 1, 2$

2. Sub each x -value into the equation.

3. Determine values for y .

4. Plot each point (x, y) on the x - y plane.

5. (Optional) Calculate first differences, which are the differences between *consecutive* y -values for *consecutive* x -values.

$$y = \frac{1}{3}x + 4$$

x	y
-6	2
-3	3
0	4
3	
6	

Apr 14-7:45 PM

Create a TOV for $y = 2x + 1$

x	$y = 2x + 1$	$\Delta y = y_2 - y_1$
-2	$2(-2) + 1 = -3$	
-1	$2(-1) + 1 = -1$	$-1 - (-3) = 2$
0	$2(0) + 1 = 1$	$1 - (-1) = 2$
1	$2(1) + 1 = 3$	$3 - (1) = 2$
2	$2(2) + 1 = 5$	$5 - (3) = 2$

' Δ ' (delta) means "change in" or "difference".

Δy is the change in y, or the first difference.

In a linear relationship, the first differences are constant.

Apr 14-7:48 PM

Ex.1. Create a TOV for $y = x^2$

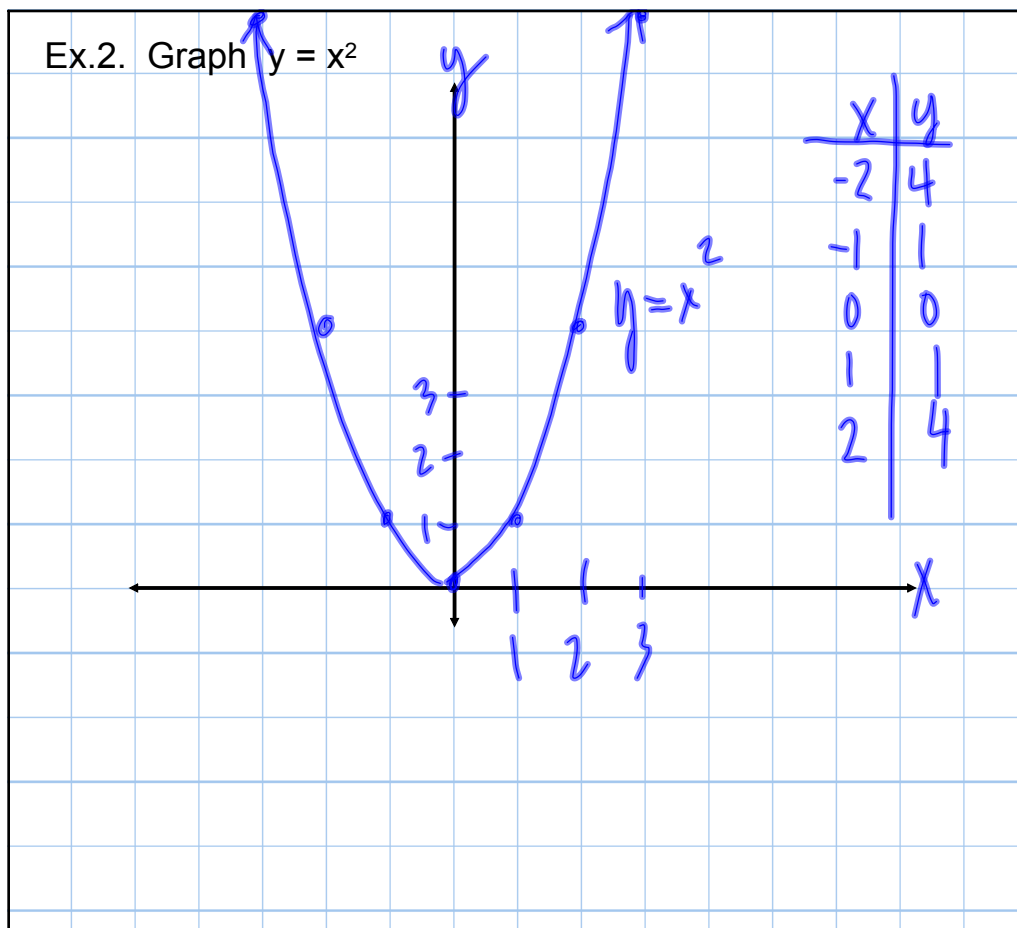
x	$y = x^2$	Δy	$\Delta^2 y$
-2	$(-2)^2 = 4$		
-1	$(-1)^2 = 1$	$1 - (4) = -3$	
0	$(0)^2 = 0$	$0 - (1) = -1$	$-1 - (-3) = 2$
1	$(1)^2 = 1$	$1 - (0) = 1$	$1 - (-1) = 2$
2	$(2)^2 = 4$	$4 - (1) = 3$	$3 - (1) = 2$

$\Delta^2 y$ is the change in Δy , or change in 1st differences.

$\Delta^2 y$ is the second difference.

In a quadratic relationship, first differences are not constant and second differences are constant.

Apr 14-8:00 PM

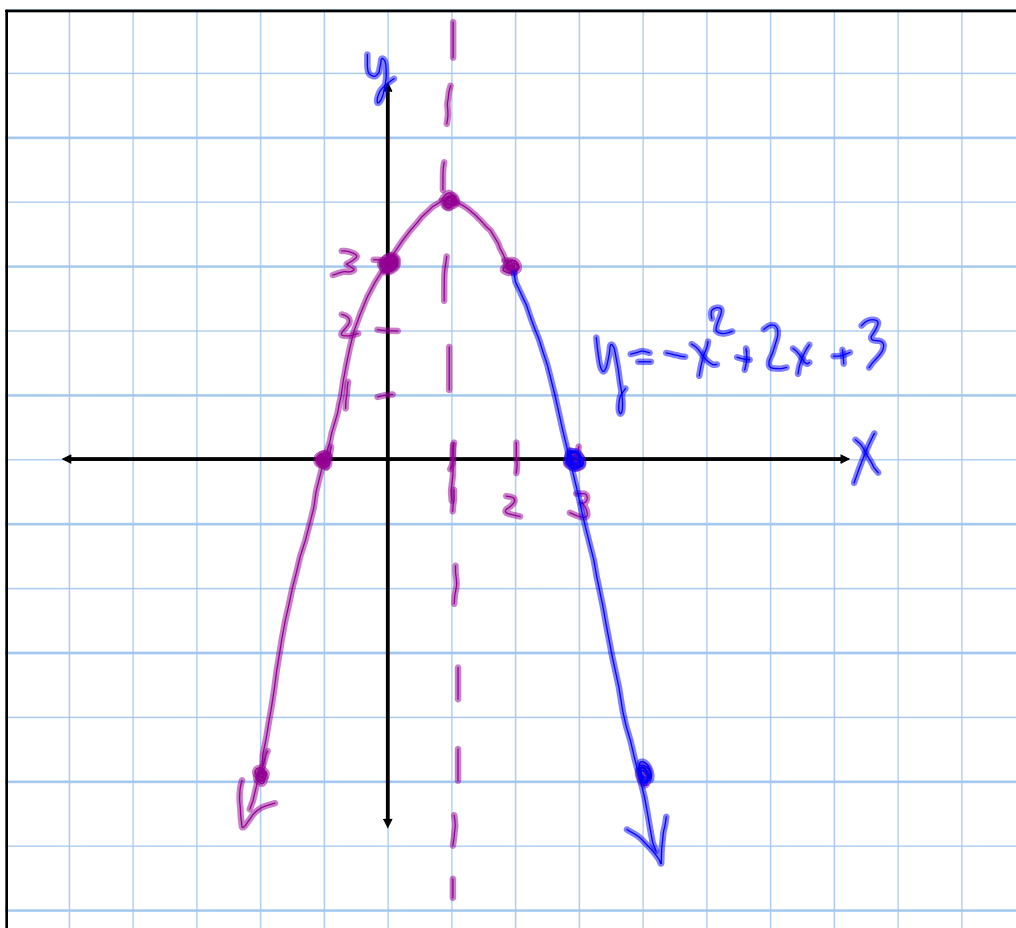


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Ex.3. Create a TOV and graph $y = -x^2 + 2x + 3$.

x	$y = -x^2 + 2x + 3$	Δy	$\Delta^2 y$
-2	$-(-2)^2 + 2(-2) + 3 = -5$		
-1	$-(-1)^2 + 2(-1) + 3 = 0$	$0 - (-5) = 5$	
0	$-(0)^2 + 2(0) + 3 = 3$	$3 - (0) = 3$	$3 - (5) = -2$
1	$-(1)^2 + 2(1) + 3 = 4$	$4 - (3) = 1$	$1 - (3) = -2$
2	$-(2)^2 + 2(2) + 3 = 3$	$3 - (4) = -1$	$-1 - (1) = -2$

Apr 14-8:10 PM



Mar 31-8:51 AM

For any parabola, $y = ax^2 + bx + c$, the direction of opening can be determined from:

- the graph
- the sign of the 2nd difference
- the sign of "a"

Positive "a" value
Positive 2nd difference \Rightarrow parabola opens up.

Negative "a" value
Negative 2nd difference \Rightarrow parabola opens down.

Assigned Work:
p. 137 # 1, 2, 3, 4, 5ab, 6, 7

Mar 20 - 4:57 PM